

Kaon Update

New WCTrack reconstruction algorithm and aerogel cut
for the study of Kaons in LArIAT

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New WCTrack Reco

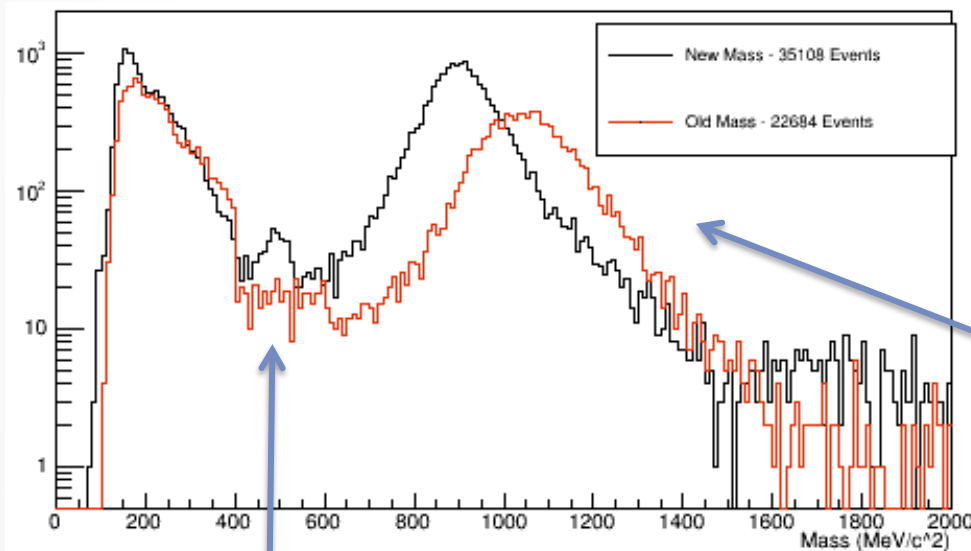
Greg Pulliman developed a new WCTrack Reconstruction Algorithm

Reconstructs events with hits on only three wire chambers.

Necessary for WC3 was flaky for Run I.

Improvement could also attributed to corrections of geometry files

Reco. Mass – Run I – Pos. B-Field Events



	# Events
New	35108
Old	22684

Proton peak moves to more correct mass and is thinner

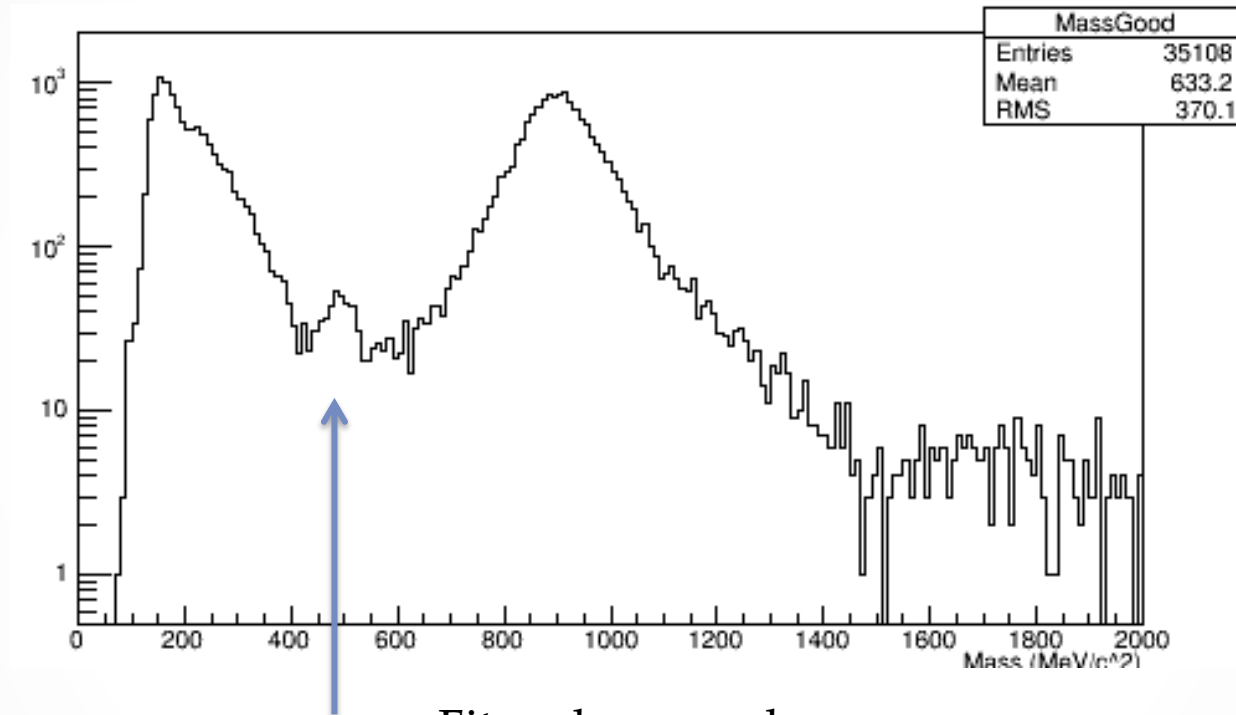
First Kaon peak of LArIAT

Pz Reco. effects Mass Reco. according to: $m = \frac{p}{c} \sqrt{\left(\frac{c * TOF}{\ell}\right)^2 - 1}$

Where ' ℓ ' \approx 6.7 m, the distance between TOF paddles.

New Mass Peak

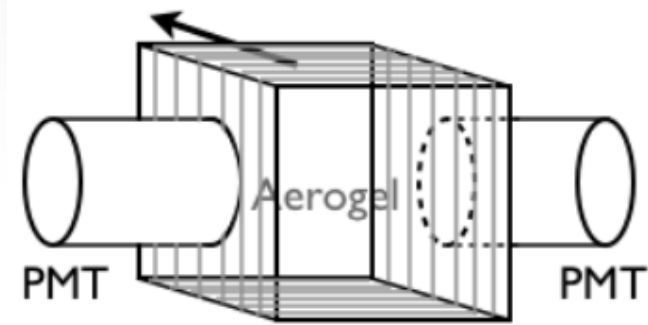
Reco. Mass – Run I – Pos. B-Field Events



Fit on kaon peak:
 $483 \pm 44 \text{ MeV}/c^2$

This value can be used for the Mass Cut / Beamline PID for kaons

Aerogel Cut



From looking at events, there is heavy pion and proton contamination.
Aerogel can be used to tag and remove pions from the kaon sample

A particle produces Cherenkov radiation after a threshold energy and momentum defined by:

$$E = \frac{m}{\sqrt{1 - \left(\frac{1}{n}\right)^2}} \quad p = \sqrt{E^2 - m^2}$$

In LArIAT, the Aerogel have refraction indices of $n = 1.05$ and 1.10 , leading to a momentum thresholds of:

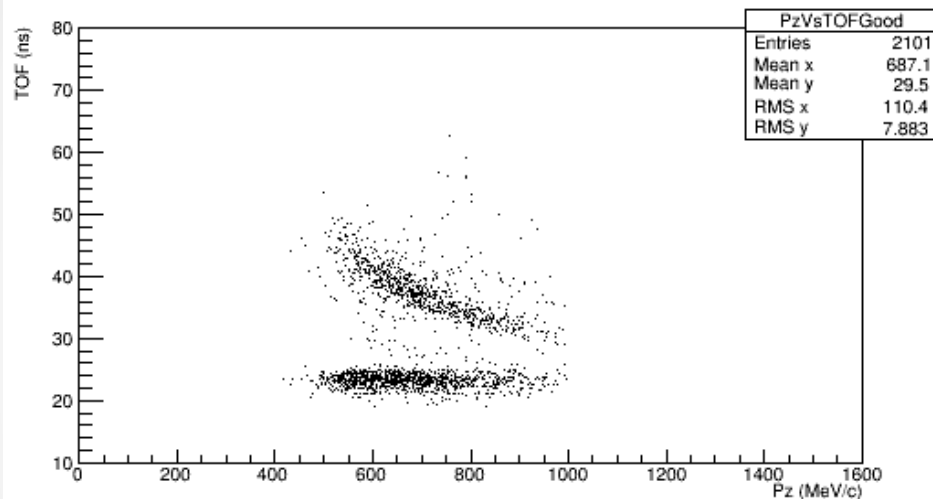
	Pi+ (MeV/c)	K+ (MeV/c)	Proton (MeV/c)
$n = 1.05$	437	1555	3000
$n = 1.10$	306	1087	2046

Range 306 to 1087 MeV/c encompasses all of the kaon sample from Run I

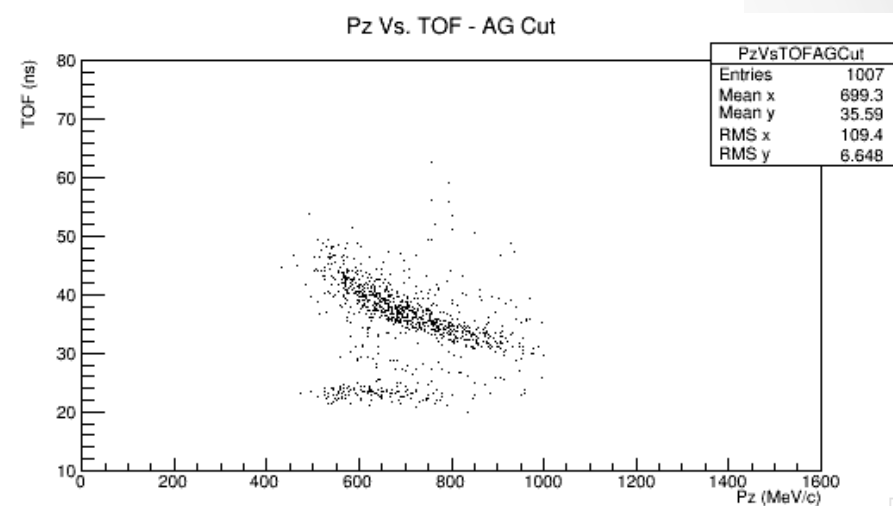
Aerogel Cut - Efficiency

Run 6259 with a cut on P_z at 1000 MeV/c

All Events



Events without A.G. Hits



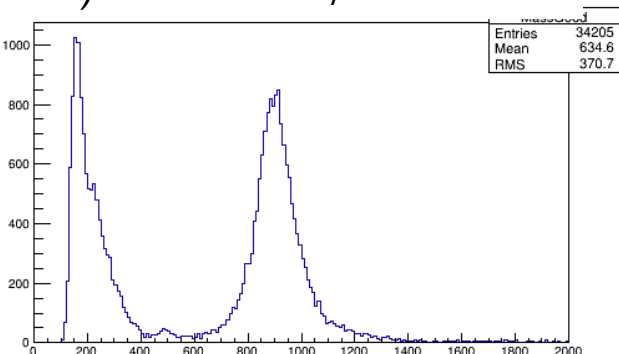
	All	Without A.G. Hits	
Pi/Mu	753	80	10.6%
Proton	878	827	94.2%

From the protons, we can expect a 5.8% miss-tag rate

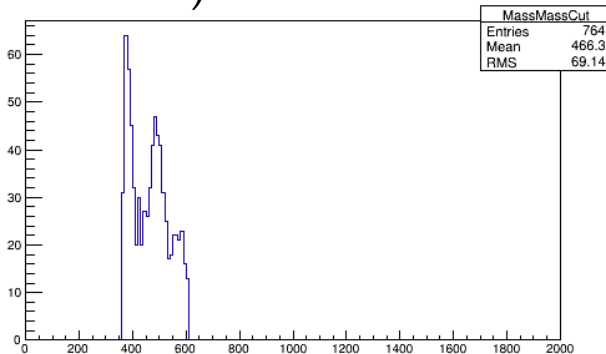
Reduction Table

Reco. Mass – Run I – Pos. B-Field Events

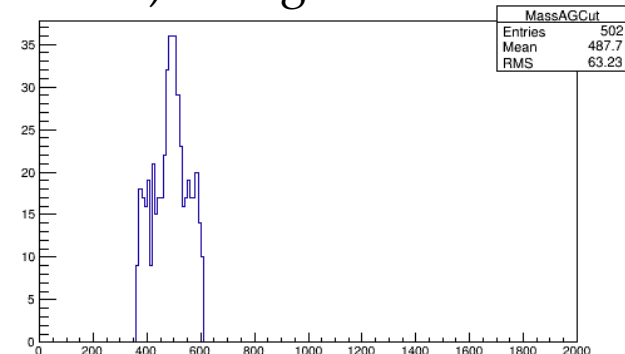
1) Good TOF/ WCTrack



2) Mass Cut



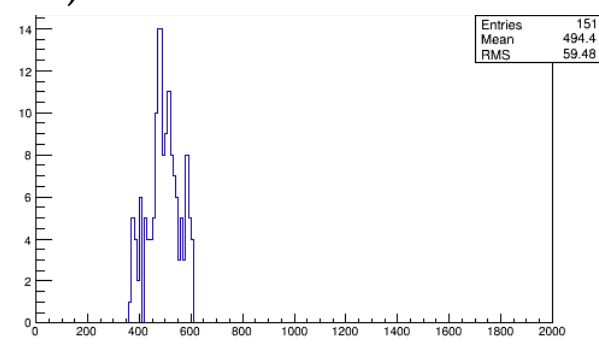
3) Aerogel Cut



All Run I Events with Positive Bending Magnet Polarity

Cut	Remaining Events
Single TOF/WCTrack	34205
Mass Cut	764
Aerogel Cut	502
TPC Track Reco / Cuts	151

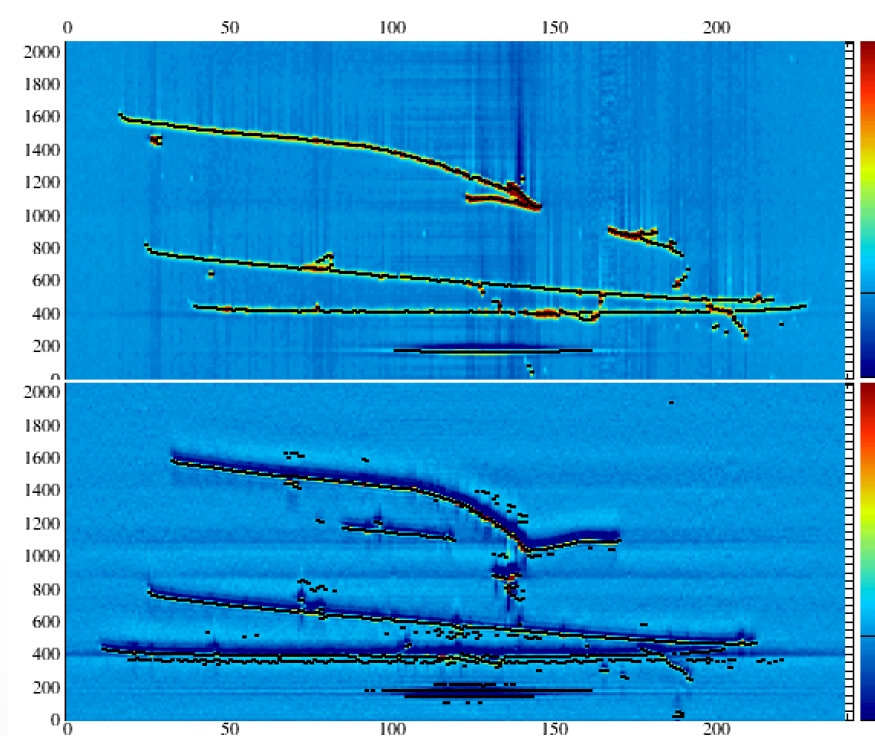
4) TPC Track # and Match



151 Events under current K⁺ sample for Run I

Future Work

- Develop a cut to bring down Proton contamination (in the works)
- Beamline study to determine time required for desired statistics
- Examine Run II for its kaon potential
- Monte Carlo – No LArIAT Kaon Monte Carlo has been done yet
- Much Much More



Backup

TPC Cuts

First, several cuts are necessary to associate the beamline and TPC tracks.
These cuts were created by the Pion group.

1) Single TPC track

UpstreamTPCMultipliciryFilter.fcl (sic) and UpstreamTPCTrackFilter.fcl

Limits the number of Upstream TPC events to one, meaning only one particle has entered the TPC during this event

2) WCTrack and TPC Track Matching

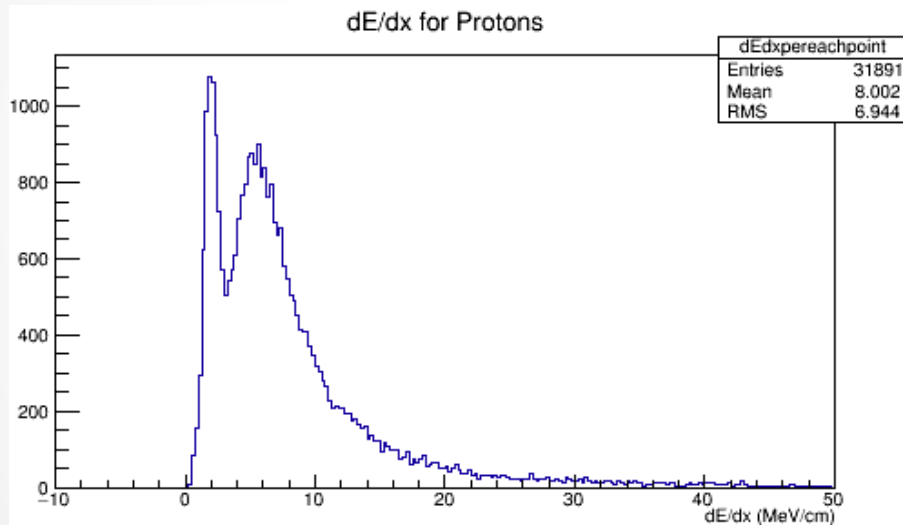
WC2TPCTrackMatch.fcl and WC_TPC_TrackMatchFilter.fcl

Matches WC Tracks with TPC Tracks by extrapolating the WCTrack to the TPC face and measuring the positional / angular difference with TPC Track.

Proton Calorimetry Study

With these cuts, we can begin to study Proton Calorimetry

Created this proton sample from a mass cut on beam reco.



Two apparent landau distributions are present. Possible explanations:

- Incorrect TPC/WCTrack matching
- TPC track multiplicity
- Through going protons?

Higher MPV: 5.43 MeV/cm